

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-201082

(43)Date of publication of application : 16.07.2002

(51)Int.Cl.

C04B 38/00
B01D 39/20
B01D 53/86
B01J 35/04
C04B 38/06
F01N 3/02

(21)Application number : 2001-032699

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(22)Date of filing : 08.02.2001

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(30)Priority

Priority number : 2000113513

Priority date : 14.04.2000

Priority country : JP

2000337936

06.11.2000

JP

(54) HONEYCOMB STRUCTURED BODY AND METHOD OF MANUFACTURING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a honeycomb structured body which is sufficiently porous with high specific surface area, preferably useable for automobile exhausting gas purifying filter even under high SV condition, containing fire resistant powder such as silicon carbide but can be economically manufactured with relatively low firing temperature, and the thermal conductivity of which is set at a proper value, by processing of plugging or catalyst supporting, etc.

SOLUTION: The porous honeycomb structured body is composed of a lot of axial through holes surrounded by partitions containing aggregates of fire resistant powder 11, and metallic silicon 10.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the honeycomb structure object used for a filter, catalyst support, etc. for motor exhaust purification.

[0002]

[Description of the Prior Art] The porous honeycomb structure object is widely used as catalyst support for supporting the catalyst component which purifies the filter for carrying out uptake removal of the particulate matter contained in dust-containing fluid like diesel-power-plant exhaust gas, or the harmful matter in exhaust gas. Moreover, using a fireproof particle like a silicon carbide (SiC) particle as a component of such a honeycomb structure object is known.

[0003] As a concrete related technique, while having a predetermined specific surface area, the silicon carbide powder containing an impurity is used as a start raw material, and the nature catalyst support of porosity silicon carbide of the honeycomb structure calcinated and acquired by the configuration of a request of this after shaping and desiccation in a 1600-2200-degree C temperature requirement is indicated by JP,6-182228,A.

[0004] A vitrification material adds to the fireproof constituent which, on the other hand, contains an easy-oxidizable material or an easy-oxidizable material in JP,61-26550,A, and the silicon-carbide Plastic solid with which the manufacture approach of the vitrification material content refractories characterized by to carry out nakedness baking of the Plastic solid mixed, kneaded, and fabricated and fabricated in the furnace of a non-oxidizing atmosphere adds and fabricates an organic binder and the inorganic binder of a clay mineral system, textile glass yarn, and a silicic-acid lithium system to silicon-carbide powder at JP,8-165171,A is indicated with binding material, respectively.

[0005] Moreover, after adding and fabricating binding material, such as glassiness flux or argillaceous, to the carbonization system elementary particle used as the aggregate as the manufacture approach of the conventional nature sintered compact of porosity silicon carbide, the method of burning, hardening and manufacturing the Plastic solid at the temperature which said binding material fuses is also introduced to said JP,6-182228,A.

[0006] furthermore, to JP,61-13845,B and JP,61-13846,B Silica sand, a pottery grinding object, aluminum₂O₃, TiO₂, the metallic oxide of ZrO₂ grade, The fireproof particle by which the particle size regulation was carried out to the predetermined grain size which consists of silicon carbide, a nitride, boride, or other fireproof ingredients The suitable fireproof particle pitch diameter, fireproof particle particle size distribution, tube-like object porosity, a tube-like object average pole diameter, tube-like object pore volume, tube-like object septum thickness, etc. are indicated about the high-temperature-service ceramic filter formed in the porous cylinder-like-object-with-base-like object with fireproof binding material, such as water glass, a frit, and a cover coat.

[0007] In addition, in JP,8-13706,B, the manufacture approach of the silicon carbide / metal silicon complex which has the structure which it comes to join to one through metal silicon, and said complex using the silicon carbide and metal silicon which heat-treated silicon accumulation biomass under an argon or nitrogen-gas-atmosphere mind, and were formed is indicated.

[0008]

[Problem(s) to be Solved by the Invention] Although a silicon carbide component evaporates from a

silicon carbide particle front face, the neck section grows because this condenses in the contact section between particles (neck section), and an integrated state is obtained with the sintering gestalt (necking) by the recrystallization reaction of the silicon carbide powder itself shown in said JP,6-182228,A. In order for this to have to cause cost quantity since a very high burning temperature is required, and to evaporate silicon carbide and to have to carry out elevated-temperature baking of the ingredient with a high coefficient of thermal expansion, there was a problem that a baking yield fell.

[0009] Moreover, it had the fault that growth of the neck section will be barred since the sintering-machine style concerned stops fully functioning, and will originate in this, and the reinforcement of a filter will fall by sintering by the recrystallization reaction of the above silicon carbide powder itself if it is going to manufacture the filter which is high porosity, and the filter which has 50% or more of especially porosity.

[0010] Furthermore, though advantageous, a catalyst is support in that the above-mentioned ingredient has thermal conductivity very as high as 30 or more W/mK, and local generation of heat is suppress, for example, and when a particulate is use for the filter of the method which oxidizes and burns and is reproduce continuously, time amount is take for the temperature of support to go up very much according to the description of there be little particulate alimentation and be easy to radiate heat.

Therefore, in order to take time amount for temperature to go up to the temperature as which a catalyst functions, the particulate cinder arose and it also had problems, like regeneration efficiency falls.

[0011] The technique of combining the coal-for-coke-making-sized silicon powder shown in JP,61-26550,A or JP,6-182228,A by glassiness. Although it is low and ends with 1000-1400 degrees C as a burning temperature for example, in using as an ingredient of the diesel particulate filter (DPF) for removing the particulate contained in the exhaust gas discharged from a diesel power plant in the sintered compact produced by this technique. When it was going to burn the particulate which uptake was carried out to the filter and deposited for filter playback, since thermal conductivity was small, there was a trouble that local generation of heat arose.

[0012] Furthermore, although the filter shown in JP,61-13845,B and JP,61-13846,B was porosity, septa are 5-20mm and a thick cylinder-like-object-with-base-like object, and were not able to apply it to the bottom of a high SV (space velocity) condition like the filter for motor exhaust purification.

[0013] Moreover, although the complex concerned could also be made into porosity by the complex shown in JP,8-13706,B, and its manufacture approach, it was not easy to face to use it as a filter and to secure sufficient porosity, and it was difficult to use it as a filter for carrying out uptake removal of the particulate matter contained in dust-containing fluid like diesel-power-plant exhaust gas especially in the complex concerned.

[0014] thermal conductivity be set as the moderate numeric value, and this invention be fully porosity and high specific surface area, and aim at offer the honeycomb structure object which can be suitably use also under high SV conditions as a filter for motor exhaust purification by processing of *****, catalyst support, etc., and its manufacture approach while being able to manufacture them cheaply with comparatively low burning temperature, though it be make in view of such a conventional situation and a fireproof particle like a silicon carbide particle be include.

[0015]

[Means for Solving the Problem] According to this invention, it is the honeycomb structure object which has the circulation hole of a large number penetrated to the shaft orientations divided by the septum, and honeycomb structure object ** characterized by being porosity is offered including the fireproof particle and metal silicon used as the aggregate.

[0016] Moreover, after according to this invention adding metal silicon and an organic binder in a fireproof particle raw material, fabricating the plastic matter mixed, and kneaded and obtained in a honeycomb configuration, carrying out temporary quenching of the acquired Plastic solid and removing the organic binder in a Plastic solid, manufacture approach ** of the honeycomb structure object characterized by carrying out actual baking is offered.

[0017]

[Embodiment of the Invention] Since metal silicon for the honeycomb structure object of this invention to combine these refractoriness particle with a fireproof particle as aforementioned is included, it can be made to sinter with a comparatively low burning temperature at the time of the manufacture, and the yield can be raised while holding down a manufacturing cost. Moreover, even if it burns the particulate

deposited for filter playback when it is used, for example for DPF since it has high thermal conductivity as compared with the conventional structure which used glassiness for association of a fireproof particle by having used metal silicon for association of a fireproof particle, local generation of heat which damages a filter does not arise. Furthermore, since this invention is not the cylinder-like-object-with-base-like object of a thick wall as shown in JP,61-13845,B or JP,61-13846,B but a porous honeycomb structure object, it can be used under high SV conditions as a filter, catalyst support, etc. for motor exhaust purification.

[0018] Moreover, as for the honeycomb structure object of this invention, it is desirable that the fireproof particle which constitutes the honeycomb structure object concerned has the structure combined with metal silicon in a part of the particle front face. It is the honeycomb structure object applied to this invention at drawing 2, and the microphotography which is the crystal structure of the nature sintered compact of silicon carbide is shown. For a white part, metal silicon 10 and a gray part are [the silicon carbide particle 11 and a black part] pores 12 among drawing. Thus, it turns out that the particles to which the silicon carbide particle 11 which is a fireproof particle exists in a perimeter in a part of the particle front face are combined with metal silicon 10. In addition, the manufacture approach of the nature sintered compact of silicon carbide shown in drawing 2 is mentioned later.

[0019] Since the above-mentioned structure is formed without using the metal silicon beyond the need, it can suppress the eburnation by fusion of the metal silicon comrade who occurs in the process of baking. For this reason, sufficient porosity is secured although the pressure loss at the time of using as a filter is suppressed low. Furthermore, since it has the high heat conductivity even if it burns the particulate deposited for filter playback while the high porosity in the case of using as DPF for carrying out uptake removal of the particulate contained in the exhaust gas discharged from a diesel power plant since it also has the high heat conductivity therefore etc. is fully secured, local generation of heat which a filter damages does not arise.

[0020] As for the honeycomb structure object of this invention, it is desirable that the viewpoint which avoids the above local generation of heat to the thermal conductivity is 5 or more W/mK.

[0021] Moreover, as for the honeycomb structure object of this invention, it is desirable to have the structure combined with metal silicon as the microstructure after the fireproof particle had stopped the raw material particle shape. When using the particulate matter contained in dust-containing fluid in the honeycomb structure object of this invention as a filter for carrying out uptake removal, it is desirable to make the porosity into 30 - 90% of range. If the porosity of a honeycomb structure object runs short of filtration velocity at less than 30% and exceeds 90%, the reinforcement as the structure runs short. Furthermore, when using for the application for which we are anxious about the pressure loss of the filter for motor exhaust purification etc., it is desirable to make porosity into 40% or more.

[0022] furthermore, in being the honeycomb structure object used as filters which must suppress pressure loss low, such as a filter of the method which a catalyst is supported [method] and burns a particulate continuously It is desirable that there is porosity and thermal conductivity is in the range of 5 - 30 W/mK 50 to 90%, it is still more desirable that there is porosity and thermal conductivity is in the range of 7 - 28 W/mK 50 to 80%, and especially the thing that there is porosity and thermal conductivity is in the range of 9 - 25 W/mK 53 to 70% is desirable.

[0023] In the honeycomb structure object used as a filter of the method which makes a catalyst support, since pressure loss goes up by supporting a catalyst, it is necessary to set up porosity highly beforehand. Therefore, at less than 50%, since pressure loss becomes large with the filter of this method, porosity is not desirable. On the other hand, if porosity exceeds 90%, since the reinforcement as the structure runs short, it is not desirable.

[0024] Furthermore, in the honeycomb structure object used as a filter of said method, it is necessary to suppress that local stress occurs in a filter according to generating of the uneven temperature distribution by local generation of heat. Therefore, it becomes difficult for thermal conductivity to suppress local generation of heat effectively in less than 5 W/mK. Since it may originate in that the effectiveness of heat dissipation is large, that there is little particulate alimentation, etc. on the other hand if the heat conductivity exceeds 30 W/mK, a particulate cinder may arise while taking great time amount to carry out a temperature up even to the temperature as which a catalyst functions that it is hard to go up temperature, and the regeneration efficiency of a filter may fall, it is not desirable.

[0025] In addition, although the catalyst supported by the filter as used in the field of this invention is a

catalyst used for the purpose of particulate oxidation combustion and decomposition of NOX and oxides, such as noble metals, such as platinum, palladium, a rhodium, iridium, and silver, or an alumina, a zirconia, a titania, Seria, and an iron oxide, etc. can specifically be used, this invention is not limited to these things.

[0026] When using the honeycomb structure object of this invention as a filter similarly, as for the average pole diameter of a honeycomb structure object, determining according to the object to filter is desirable. For example, when using as DPF for carrying out uptake removal of the particulate contained in the exhaust gas discharged from a diesel power plant, it is desirable to make an average pole diameter into the range of 2-50 micrometers. if a pressure loss goes up remarkably and it exceeds 50 micrometers conversely also by little deposition of a particulate [pole diameter / average] in less than 2 micrometers -- particulate base -- since an omission happens, it is not desirable.

[0027] Although the suitable content of the metal silicon in the honeycomb structure object of this invention changes also with the particle size and particle shape of a fireproof particle, it is desirable to consider as 5 - 50% of the weight of within the limits to the total quantity of a fireproof particle and metal silicon, and it is still more desirable to consider as 15 - 40% of the weight of within the limits. Less than 5 % of the weight of association by the metal silicon of the fireproof particles which adjoin since binding material is insufficient is insufficient, and it becomes difficult to obtain the reinforcement which thermal conductivity not only falls, but can maintain the structure of a thin wall like honeycomb structure. Conversely, if it exceeds 50 % of the weight, in the point which originates in metal silicon existing more than it can combine fireproof particles appropriately, and a honeycomb structure object (sintered compact) contracts too much by sintering, and evils, such as a porosity fall and average pole diameter contraction, concur with, it is not desirable.

[0028] As for the thickness of the septum with which the circulation hole (cel) of a honeycomb structure object is divided, it is desirable to be referred to as 4 or more (102 micrometers or more) mil. Under 4mil (102 micrometers) of the reinforcement as the structure is [the thickness of a septum] insufficient. Moreover, reinforcement had porosity and a close relation, when in the case of the honeycomb structure object of this invention setting up the thickness of a septum so that the thickness and the porosity of a septum might fill the following relation, required reinforcement was obtained, and the desirable thing became clear.

[Equation 4] Thickness (micrometer) \geq porosity (%) x4[0029] of a septum Furthermore, if the thickness of a septum is set up so that the thickness and the porosity of a septum may fill the following relation, since sufficient reinforcement will be obtained, it is more desirable.

[Equation 5] Thickness (micrometer) \geq porosity (%) x5[0030] of a septum On the other hand, when using as filters, such as DPF, it is desirable to set thickness of a septum to 50 or less (1270 micrometers or less) mil. When the thickness of a septum exceeds 50mil (1270 micrometers), it is for being anxious about the lack of filtration velocity, or a pressure drop buildup. In addition, there is close relation to porosity also about this, and a problem can be avoided by setting up the thickness of a septum so that the thickness and the porosity of a septum may fill the following relation.

[Equation 6] Thickness (micrometer) \leq porosity (%) x20[0031] of a septum As for the cel consistency of a honeycomb structure object, it is desirable to consider as the range of 5-1000 cel / square inch (0.7 - 155 cel / cm²). a cel consistency -- 5 cels / square -- under in an inch (0.7 cels / cm²), while becoming insufficient [reinforcement] as a honeycomb structure object, when it uses as a filter, filtration areas also run short. On the contrary, it is not desirable in order to cause a pressure drop buildup, if 1000 cel / square inch (155 cels / cm²) is exceeded.

[0032] Next, the manufacture approach of the honeycomb structure object of this invention is explained. In manufacturing the honeycomb structure object of this invention, first, metal silicon and an organic binder are added in a fireproof particle raw material, it mixes and kneads in it, and the plastic matter for shaping is obtained.

[0033] although especially the class of fireproof particle to be used is not limited -- an oxide system -- aluminum₂ -- O₃, ZrO₂, Y₂O₃, and a carbide system -- SiC and a nitride system -- Si₃ -- thermal resistance of SiC is high for applications, such as DPF which particles, such as N₄, AlN, and other mullites, are used suitably, for example, is often exposed to an elevated temperature at the time of combustion processing of an are recording particulate, and it is suitably used for them. In addition, although there is a case containing the impurity of minute amounts, such as Fe, aluminum, and calcium,

in the raw material used for fireproof particle metallurgy group silicon, you may use it as it is and what performed and refined chemical processing of chemical washing etc. may be used.

[0034] As for the mean particle diameter of a fireproof particle raw material, it is desirable that it is 2 to 4 times the average pole diameter of the honeycomb structure object (sintered compact) finally acquired by this manufacture approach. Since the honeycomb structure object acquired by this manufacture approach has a comparatively low burning temperature, the particle shape and particle size of a fireproof particle raw material are maintained in general until after baking. Therefore, such reinforcement high [particle size is too small to a desired pole diameter in said ratio being under 2 double, and] cannot be obtained that it will be combined long and slender with metal silicon, and a fireproof small particle group will form big pore and can maintain the structure of a thin wall like a honeycomb structure object as a result.

[0035] Moreover, for example, the recrystallization SiC conventionally applied to the porosity honeycomb structure object when a fireproof particle is a SiC particle The SiC particle combined from the reaction mechanism with metal silicon like the honeycomb structure object of this invention to needing an aggregate raw material particle size almost equivalent to the pole diameter considered as a request Since **** [particle size / twice / more than / the pole diameter], when it is going to obtain the same pole diameter, compared with Recrystallization SiC, a cheap raw material can be used coarsely, and a cost merit is also large.

[0036] On the contrary, when said ratio exceeds 4 times, the particle size of the fireproof particle used to a desired pole diameter is too large, and it is not desirable by being densely filled up with a fireproof particle in the phase of shaping at the point which becomes difficult [it / to obtain desired pore] for the gap, and causes a porosity fall for a filter application further.

[0037] Metal silicon melts during baking, wets the front face of a fireproof particle, and bears the role which combines particles. Although the suitable addition changes also with the particle size and particle shape of a fireproof particle, it is desirable to make it become to the total quantity of a fireproof particle and metal silicon 5 - 50% of the weight of within the limits. At less than 5 % of the weight, since metal silicon exists superfluously more than it can combine fireproof particles appropriately if binding material is insufficient, and the reinforcement which can maintain the structure of a thin wall like honeycomb structure cannot be obtained but it exceeds 50 % of the weight conversely, evils, such as a porosity fall and average pole diameter contraction, occur at the same time.

[0038] As for the mean particle diameter of metal silicon, it is desirable that it is 50% or less of the mean particle diameter of the fireproof particle which is the aggregate. If the particle size exceeds 50% of the particle size of a fireproof particle in order to move melting and gathering by baking so that it may coil around a fireproof particle, at the time of shaping, the space which this metal silicon particle occupied serves as a big opening, metal silicon remains, a fall on the strength is caused, or when using it as a filter, it will cause filter degradation (leakage in filtration).

[0039] Moreover, also in order for the direction which generally mixes two or more sorts of raw material powder with a grain-size difference at the time of extrusion molding of a honeycomb structure object to be able to extrude smoothly and to obtain an organization suitable as a porous body, it is desirable to make mean particle diameter of metal silicon into 50% or less of the mean particle diameter of the fireproof particle which is the aggregate.

[0040] In order to use a fireproof particle as the aggregate and to carry out extrusion molding of the plastic matter which comes to blend an ostomy agent etc. metal silicon and if needed to a honeycomb configuration smoothly, it is desirable to add one or more sorts of organic binders 2% of the weight or more by outside ** as a shaping assistant to the total quantity of the main raw material (a fireproof particle raw material and metal silicon). However, in order that the addition exceeding 30 % of the weight may cause superfluous high porosity and may make the lack of on the strength result after temporary quenching, it is not desirable.

[0041] Furthermore, when the thickness of a septum carries out extrusion molding to the honeycomb structure object below 20mil (508 micrometers), it is desirable to add in 4 - 20% of the weight of the range. an addition -- less than 4 % of the weight -- ** -- if it is difficult to extrude in a thin wall [like] and it exceeds 20 % of the weight conversely, it will become difficult to maintain the configuration after extrusion.

[0042] When using a honeycomb structure object as a filter, an ostomy agent may be added at the time

of preparation of a plastic matter in order to raise porosity. As for the addition of an ostomy agent, it is desirable to consider as 30 or less % of the weight by outside ** to the total quantity of the main raw material (a fireproof particle raw material and metal silicon). If an addition exceeds 30 % of the weight, porosity will become high too much and it will result in the lack of on the strength.

[0043] In addition, when acquiring the honeycomb structure object which is 50% or more of high porosity, it is desirable to add an ostomy agent. The honeycomb structure object which is the high porosity by which pore volume distribution was controlled is producible by choosing suitably the class of ostomy agent used at this time, mean particle diameter, etc. That is, although the gap between the particles of the fireproof particle which is the aggregate serves as pore in this invention, the honeycomb structure object of high porosity which has the pore volume distribution which consists of two pore volume distribution of the gap between the particles of a fireproof particle and the remains of destruction by fire of an ostomy agent is producible by carrying out suitable amount addition of the ostomy agent which has mean particle diameter 1.2 to 4 times the particle size of the fireproof particle which is the aggregate. Therefore, the flexible materials design corresponding to required pore volume distribution becomes possible by choosing suitably the particle size of a fireproof particle and an ostomy agent.

[0044] On the other hand, in order to produce a honeycomb structure object with a large pole diameter, when using fireproof particle metallurgy group silicon with a big particle size, a plastic matter can be smoothly extruded at the time of extrusion molding by carrying out suitable amount addition of the ostomy agent which has 0.5 or less times [of the mean particle diameter of a fireproof particle] particle size. Therefore, the honeycomb structure object of high porosity can be produced, without lowering a moldability.

[0045] Although especially the class of ostomy agent to be used is not limited, it can specifically mention graphite, wheat flour, starch, phenol resin, a polymethyl methacrylate, polyethylene, polyethylene terephthalate, etc. an ostomy agent -- the purpose -- responding -- one sort -- or two or more sorts may be combined and you may use.

[0046] Said raw material is fabricated in the honeycomb configuration of a request of the plastic matter mixed, and kneaded and obtained by the conventional method by an extrusion method etc. Subsequently, this baking is performed after removing the organic binder which carries out temporary quenching of the acquired Plastic solid, and is contained in a Plastic solid (cleaning). As for temporary quenching, it is desirable to carry out at temperature lower than the temperature which metal silicon fuses. You may once hold at the predetermined temperature of about 150-700 degrees C, and to below 50 degrees C / hr, a programming rate may be made late and, specifically, may carry out temporary quenching in a predetermined temperature region.

[0047] About the technique once held at predetermined temperature, with the class and amount of an organic binder which were used, maintenance or maintenance with the two or more temperature level of only a 1 temperature level is sufficient, and in holding with the two or more temperature level further, even if the same, you may change the holding time mutually. Moreover, between a certain 1 temperature-province regions may be similarly made late about the technique of making a programming rate late, or you may make it late among the two or more division, and, in between the two or more [further] division, a rate may be mutually changed also as the same.

[0048] Although an oxidizing atmosphere is sufficient, in order that it etc. may burn violently with oxygen and may make Plastic solid temperature rise rapidly during temporary quenching about the ambient atmosphere of temporary quenching when many organic binders are contained in a Plastic solid, it is also desirable technique by carrying out by inert atmospheres, such as N₂ and Ar, to control the abnormality temperature up of a Plastic solid. Control of this abnormality temperature up is important control when a raw material with a large (weak to a thermal shock) coefficient of thermal expansion is used. It is desirable to carry out temporary quenching of the organic binder in said inert atmosphere, when it adds more than 20 % of the weight (outside **) for example, to the main raw material.

Moreover, also when it is what is anxious about the oxidation in an elevated temperature besides in case a fireproof particle is a SiC particle, it is desirable to control oxidation of a Plastic solid by performing temporary quenching according to the above inert atmospheres above the temperature from which oxidation begins at least.

[0049] The furnace of identitas or another individual may perform this baking following temporary quenching and it as another process, and it is good also as a continuous process in the same furnace.

When carrying out temporary quenching and this baking in a different ambient atmosphere, the former is desirable technique, and from standpoints, such as the total firing time and operation cost of a furnace, the latter technique is also desirable.

[0050] Metal silicon needs to become soft in order to obtain the organization where the fireproof particle was combined with metal silicon. Since the melting point of metal silicon is 1410 degrees C, as for the burning temperature in the case of this baking, it is desirable to consider as 1400 degrees C or more. Furthermore, the optimal burning temperature is determined from a microstructure or a characteristic value. However, since association which evaporation of metal silicon progressed at the temperature exceeding 1800 degrees C, and minded metal silicon becomes difficult, as a burning temperature, 1400-1800 degrees C is suitable.

[0051] In addition, although the sintered compact of high thermal conductivity is obtained in order to combine the manufacture approach using the recrystallizing method shown in aforementioned JP,6-182228,A by silicon carbide particles Since it sinters by the evaporation condensation device in which it stated previously, in order to evaporate silicon carbide A burning temperature higher than the manufacture approach of this invention is needed, and in order to obtain a practically usable silicon carbide sintered compact, it is usually necessary to calcinate at least 1800 degrees C or more at an elevated temperature 2000 degrees C or more.

[0052] choosing according to the class of fireproof particle about the ambient atmosphere of this baking -- desirable -- for example, the particle of carbide including SiC and Si₃ -- the particle of the nitride represented by N₄ and AlN of considering as non-oxidizing atmospheres, such as N₂ and Ar, etc. is desirable in the temperature region beyond the temperature from which oxidation begins at least about what is anxious about the oxidation in an elevated temperature.

[0053]

[Example] Hereafter, although this invention is further explained to a detail based on an example, this invention is not limited to these examples.

[0054] (Examples 1-13, examples 1-2 of a comparison) It blended so that it might become the presentation which shows the SiC raw material powder which has mean particle diameter as shown in Table 1, and metal Si powder with a mean particle diameter of 4 micrometers in this table, and the methyl cellulose 6 weight section, the surfactant 2.5 weight section, and the water 24 weight section were added as an organic binder to this powder 100 weight section, it mixed and kneaded to homogeneity, and the plastic matter for shaping was obtained. The obtained plastic matter was fabricated with the extruding press machine in 0.43mm in the outer diameter of 45mm, die length of 120mm, and septum thickness, and the honeycomb configuration of cel consistency 100 cel / square inch (16 cels / cm²). Baking of 2 hours was performed with the burning temperature which shows this honeycomb Plastic solid in Table 1 in a non-oxidizing atmosphere after performing temporary quenching for cleaning at 550 degrees C in an oxidizing atmosphere for 3 hours, and the silicon carbide sintered compact of honeycomb structure was produced by porosity. About this sintered compact, an average pore diameter and porosity were measured in the mercury porosimeter, and thermal conductivity was measured with the laser flash method, respectively, four more point flexural strength was measured, and that result was shown in Table 1. Moreover, the microphotography which is the crystal structure of the nature sintered compact of silicon carbide produced in the example 1 to drawing 2 was shown. Furthermore, the graph which plotted porosity, reinforcement (MPa), and thermal conductivity (W/mK) (%) to the amount (wt%) of the blended metal Si powder was shown in drawing 1 . In addition, when the crystal phase was identified in the X diffraction, consisting of SiC and Si was checked.

[0055]

[Table 1]

	SiC粉末の 平均粒径 (μm)	SiC粉末の配 合量 (wt%)	金属Si粉末 の平均粒径 (μm)	金属Si粉末 の配合量 (wt%)	焼成温度 ($^{\circ}\text{C}$)	平均細孔径 (μm)	気孔率 (%)	4点曲げ強度 (MPa)	熱伝導率 (W/mK)
実施例 1	32.6	80	4	20	1450	9.0	49.0	20	21
実施例 2	32.6	80	4	20	1600	10.0	44.0	25	20
実施例 3	32.6	65	4	35	1450	12.0	45.0	25	25
実施例 4	32.6	65	4	35	1600	13.0	42.0	28	26
実施例 5	50.0	80	4	20	1450	11.6	45.0	20	21
実施例 6	50.0	80	4	20	1600	13.5	49.0	22	20
実施例 7	32.6	90	4	10	1450	9.0	45.0	16	15
実施例 8	32.6	85	4	15	1450	9.0	47.0	20	20
実施例 9	32.6	80	12	20	1450	11.0	43.0	20	20
実施例 10	32.6	80	30	20	1450	13.0	42.0	18	25
実施例 11	32.6	70	4	30	1450	12.0	47.0	27	23
実施例 12	32.6	60	4	40	1450	12.0	43.0	23	28
実施例 13	32.6	55	4	45	1450	14.0	40.0	20	30
比較例 1	32.6	97	4	3	1450	8.0	45.0	3	3
比較例 2	32.6	45	4	55	1450	16.0	25.0	18	23

[0056] (Consideration) In the example 1 of a comparison, decline in porosity was able to be checked in decline in reinforcement and thermal conductivity, and the example 2 of a comparison. On the other hand, sufficient numeric value is shown about the porosity, the reinforcement, and the thermal conductivity demanded when using as DPF for carrying out uptake removal of the particulate contained in the exhaust gas discharged from a diesel power plant in the examples 1-13 concerning this invention etc. Moreover, the graph shown in drawing 1 shows that the suitable addition of metal Si powder exists in 5 - 50% of the weight of the range to the total quantity of SiC raw material powder and metal Si powder. By this, the effectiveness which was excellent in this invention was able to be checked.

[0057] Blend the SiC raw material powder and metal Si powder which have mean particle diameter as shown in Table 2 so that it may become the presentation of this table, and this powder 100 weight section is received further. (Examples 14-20) The methyl cellulose 8 weight section, the surfactant 2.5 weight section, and the water 28 weight section were added as the weight section which shows the powder of a polymethyl methacrylate in this table as an ostomy agent, and an organic binder, and the silicon carbide sintered compact of honeycomb structure was produced by the same approach as examples 1-13 after that. In addition, each burning temperature was performed at 1450 degrees C. About this sintered compact, thermal conductivity was measured for an average pole diameter and porosity with the laser flash method by the mercury porosimeter again, respectively.

[0058]

[Table 2]

	SiC粉末の 平均粒径 (μm)	SiC粉末の配 合量 (wt%)	金属Si粉末 の平均粒径 (μm)	金属Si粉末 の配合量 (wt%)	造孔剤の平均 粒径 (μm)	造孔剤の 配合量 (%)	気孔率 (%)	平均細孔径 (μm)	熱伝導率 (W/mK)
実施例 14	32.6	80	4	20	60	20	58.0	21.0	14
実施例 15	32.6	75	4	25	12	14	53.0	13.0	25
実施例 16	47.0	85	12	15	12	20	60.0	18.0	12
実施例 17	47.0	80	12	20	12	20	58.0	15.0	16
実施例 18	68.0	85	12	15	30	20	55.0	30.0	18
実施例 19	68.0	90	12	10	60	25	66.0	40.0	10
実施例 20	32.6	80	4	20	60	30	70.0	25.0	9

[0059] (Consideration) The honeycomb structure object of this invention shows sufficient numeric value about the porosity, thermal conductivity, and average pole diameter which are demanded when using as a filter for motor exhaust purification which made the catalyst support so that clearly from Table 2. Moreover, even if it was the case (examples 16-19) where particle size of the SiC powder which is the aggregate was enlarged, the honeycomb structure object was able to be produced by adjusting the particle size and loadings of an ostomy agent, without causing poor shaping. By this, the effectiveness

which was excellent in this invention was able to be checked.

[0060]

[Effect of the Invention] As explained above, though fireproof particles, such as a silicon carbide particle, are included, since it can be made to sinter with a comparatively low burning temperature at the time of the manufacture, the honeycomb structure object of this invention can improve [yield's] while holding down a manufacturing cost, and can be offered cheaply. Moreover, even if it burns the particulate deposited for filter playback when it is used, for example for DPF since it has high thermal conductivity as compared with the conventional structure which combined the fireproof particle using glassiness, local generation of heat which damages a filter does not arise. Furthermore, since porosity and thermal conductivity are predetermined numerical range and are the honeycomb structure object of the low porosity of pressure loss, it can be suitably used also under high SV conditions as a filter for motor exhaust purification which made the catalyst support.

[Translation done.]